AGRICULTURAL Research

February 1962

PROTECTING AGRICULTURE from

- Fallout
- Medflies
- Corn Borers

United States Department of Agriculture

AGRICULTURAL
Research

February 1962/Volume 10, No. 8

Contents

Editor: H. G. Hass. Managing Editor: J. R. Madison. Contributors to this issue: H. H. Smith, B. R. Blankenship, C. L. Gaddis, C. E. Olsson, V. Bourdette, W. W. Martin, G. M. Jones, H. F. Lehnert, Jr., W. E. Carnahan, D. W. Goodman.

Recognition

Scientific literature is carefully documented with credit given those who earn it. But this is not always the case in reports of research appearing in the popular press.

Agricultural scientists credited by the press with research accomplishments may frequently feel that they get recognition that should rightfully be shared by others. And some not mentioned may understandably feel they have been slighted.

It often happens that those named in the public press simply happen to be in the right place at the right time. They may have made an important discovery that is newsworthy. Or perhaps their contribution consists mainly of uniting many facts and much data, developed earlier by other scientists, into a useful interpretation. Or, as research administrators, they may have led others in making an accomplishment.

Whatever the case, however, all who are familiar with the procedures of modern science know that the scientists who get public credit have usually been aided directly or indirectly by others. Successful agricultural research is a complex activity that almost always requires teamwork.

The most important function of a popular research report is to supply information. To be effective and used to advantage, such reports must be read by many. They will not be widely read if they must name all the people involved.

All workers contributing directly to a discovery are named whenever possible in AGRICULTURAL RESEARCH and other official outlets for USDA's research information. But when many scientists are involved in research being reported, only the man in charge may be named. This is done because of space limitations and to achieve more effective reporting.

The commercial newsman will normally introduce few personalities into his story. His aim is to provide a maximum of research information while maintaining reader interest and competing for news space.

Any widely read and appreciated report of research ultimately helps gain greater public recognition, not only for those unnamed in the report who helped in the work, but also for those in related lines of research.

AGRICULTURAL RESEARCH is published monthly by the Agricultural Research Service, United States Department of Agriculture, Washington 25, D.C. Printing has been approved by the Bureau of the Budget, August 15, 1958. Yearly subscription rate is $1 in the U.S. and countries of the Postal Union, $1.50 in other countries. Single copies are 15 cents each. Subscription orders should be sent to Superintendent of Documents, Government Printing Office, Washington 25, D.C.

Growth Through Agricultural Progress

AGRICULTURAL RESEARCH SERVICE
United States Department of Agriculture

Protecting Agriculture in the ATOMIC AGE

Valuable information to aid food producers in event of nuclear disaster and means of dealing with fallout are being developed by USDA scientists

■ Protecting U.S. agriculture in the atomic age is getting to be a big job, with agricultural scientists having an important role. In the event of nuclear war their responsibility—particularly to producers of food and fiber—would be great.

During recent years USDA has been preparing agriculture for a possible emergency by developing ways of dealing with fallout and providing information of great value to farmers and food processors.

Here is a review of what ARS has done: experimented with some success to find ways of removing dangerous fallout from soil; come close to achieving a commercially suitable method for removing strontium 90 from milk; trained radiological monitors and instructors and cooperated in starting a nationwide monitoring network; made available general information about atoms, fallout, and agriculture; compiled information on how to protect food, livestock, and farm families from fallout; advised the public on stockpiling supplies in fallout shelters; and developed an emergency wheat ration for shelter stockpiles.

At the Agricultural Research Center, Beltsville, Md., where fallout contamination of soils is being studied, scientists have learned that soil treatment and cultivation will reduce fallout levels. Should fallout contaminate a limited area, it can be completely removed by scraping off a few inches of soil.

Turn Page

623462°—62

ATOMIC AGE

(Continued)

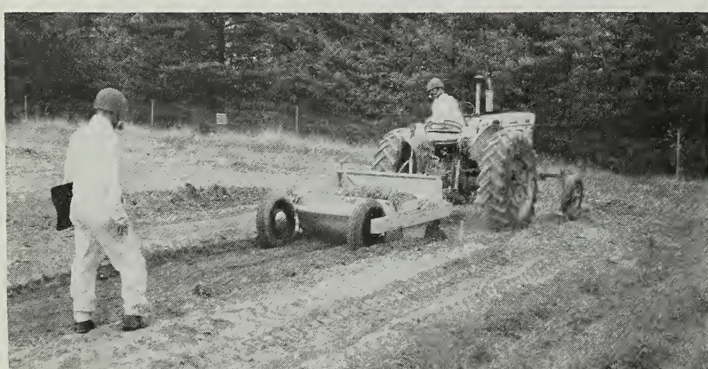
ARS scientists have also established that crops grown on soils containing an adequate amount of calcium take up minimum amounts of strontium 90. One effect of liming is to make more calcium available to plants than is the case in acid soils. Liming soils for optimum crop production, therefore, can reduce the uptake of strontium 90 in crops and pastures, especially in the humid parts of the U.S. where acid soils are common.

Removal of strontium 90 is important because it passes from cows into their milk. A few years ago. basic research done in Canada and by the Atomic Energy Commission and the U.S. Public Health Service demonstrated that it is possible to remove strontium 90 by passing milk through columns containing beads of chemicals known as ion-exchange resins. In cooperation with AEC and PHS, ARS has succeeded in adapting the process to pilot-plant scale and work is now underway to convert it to commercial scale.

Under the national plan for civil defense and defense mobilization, ARS was given the responsibility for training instructors in radiological monitoring. These instructors, in turn, are responsible for teaching monitoring techniques to officials in various USDA agencies. ARS is also responsible for providing technical guidance to agricultural officials and farmers on protection against radiation hazards to food and agriculture. These activities are under the supervision of F. A. Todd, assistant to the ARS administrator for emergency programs.

A training program, begun in 1957, is meeting part of the responsibility. Nearly 5,000 USDA employees have taken a short course in monitoring, and more than 400 others have qualified as radiological instructors. A network of Federal fixed radiological monitoring stations was recently established by the Office of Civil Defense, Department of Defense, at more than 3,000 locations across the U.S. More than 1,900 of them will be operated by USDA employees.

Monitors in West Virginia (left) using device to detect fallout in soil are part of nationwide network being set up to protect agriculture. USDA scientists (below) scrape off layer of topsoil in research to develop methods of removing fallout.



Reliable facts are being disseminated

Another part of the responsibility is being met by dissemination of reliable facts concerning atoms, radiation, and agriculture. This has been done by distribution of movie films, educational projection slides, graphic exhibits, and printed material. One Farmers' Bulletin, "Radioactive Fallout on the Farm" (USDA No. 2107), has been especially popular, and 2,403,000 copies have been printed.

"Family Food Stockpile for Survival," another USDA publication (HG–77), discusses how to store emergency fallout shelter supplies, how often to replace food stockpiles, and furnishes sample menus to provide a reasonably balanced diet using emergency rations.

ARS scientists have developed one food particularly for use in family shelters—a long-keeping whole grain wheat wafer. The wafers have an estimated shelf life of 5 years and longer and are made of wheat that has been parboiled, dried, puffed, then crumbled and formed into cookie size. Each furnishes 84 calories.☆

Farm building walls can be bolted together easily by two or three workers

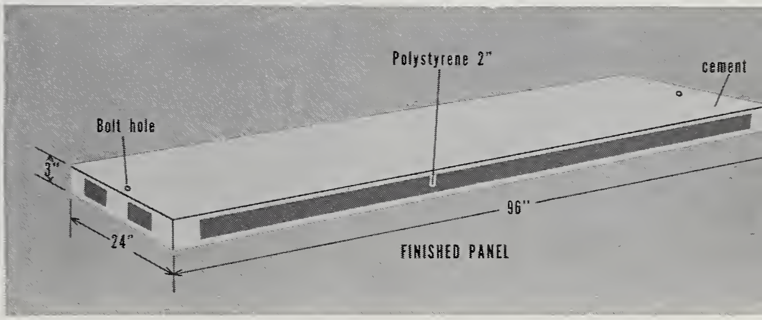
PLASTIC-CEMENT PANELS offer advantages

Panels hold up well against weathering; this test building is in good condition after nearly 2 years of exposure.

■ An experimental wall panel, made of a 2-inch layer of plastic sandwiched between half-inch layers of reinforced portland cement, has been developed by USDA agricultural engineers for use in constructing farm buildings. The panels are not yet commercially available.

These 2- by 8-foot panels are light enough (200 pounds) to be handled by two or three men and are cast with holes for bolting horizontally to the inside of wooden posts set 8 feet apart in the ground. No special tools or equipment are needed to erect a 1-story panel building.

The plastic layer is expanded polystyrene, a foam-like material made by a chemical process that increases bulk without increasing weight.



Panel life may be more than 20 years

An experimental panel building constructed at the Agricultural Research Center, Beltsville, Md., nearly 2 years ago shows no signs of weathering. ARS engineers believe the panels will last more than 20 years.

Cost estimates indicate the panels are more expensive than concrete blocks for buildings of equal size. Total building costs would be comparable, however, because a panel building can be erected about four times faster than a block building.

The panels are suitable for milking parlors, chicken houses, barns, and other enclosed livestock buildings where insulation is necessary. Tests simulating an animal falling or being pushed against the panels proved they can withstand heavy or repeated blows by livestock.

Buildings constructed of these panels would be easy to clean and disinfect, because there are no studs and the interior surface is extremely smooth. Joints are sealed with a caulking compound. Finished panels are light gray in color, but they may be painted.☆

Two bolts hold each panel in place. Studs are outside and interior walls are smooth, easy to clean.

Second in a Centennial Series:

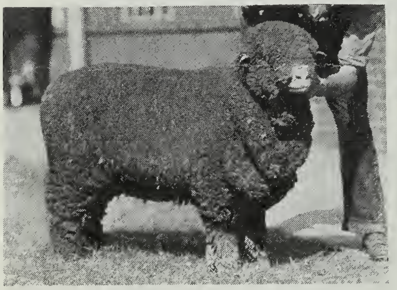
FARM ANIMALS

Milk producer, 1915. Its 4,700 pounds then was above average.

Produced 14,863 pounds in 1948. Exceptional then, not now.

Our principal grass-fed beef producer of the 1800's.

Juicy steaks today come from feedlot-fattened cattle.



Skin folds and a woolly face: lower-quality wool, fewer lambs.

Select for open face, get more, heavier lambs.

Lean-type hog yields more pork, less fat; a breeding advance.

Livestock and poultry have improved much since USDA was born 100 years ago

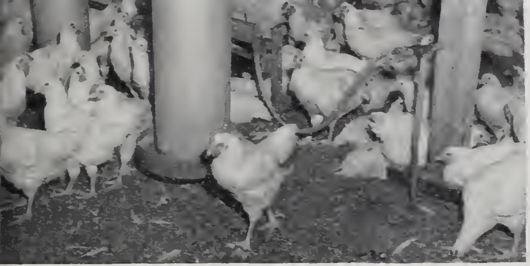
■ How farm animals have changed in the 100 years of USDA's existence!

A hundred years ago, many hogs went to market weighing more than 400 pounds. Emphasis was on fat because lard was in demand for high-energy diets. Today's ideal hog goes to market weighing 200 pounds, most of which is lean pork preferred by consumers. Research helped farmers make the change. Geneticists developed lean-type strains, and nutritionists devised rations on which hogs make fast gains, without getting too fat.

Nutrition research is largely responsible for the juicy beef cuts we enjoy today. Our forefathers' fare was mostly stringy range beef. Scientists have shown farmers how to use concentrates and forages to get ideal feedlot performance from their steers—fast weight gains and desirable finish.

In the 1900's, a milk cow yielding more than 4,000 pounds of milk per year was exceptional. Average production per cow now is more than 7,000 pounds yearly. Better handling and disease control account for some of this increase.

But feeding according to a cow's ability to produce, and breeding animals with desirable traits—both pioneered by ARS and State scientists—account for more of the increase. Production records of cows enrolled in Dairy Herd Improvement Associations attest to this. These



Three pounds of feed for a pound of meat. These broilers are only 9 weeks old and are ready for market.

This breed made Beltsville famous. The small turkey's popularity is waning now.

animals averaged more than 11.000 pounds of milk last year.

Because of a simple sheep-breeding procedure developed by an ARS scientist, ewes can produce 11 percent more lambs about 11 percent heavier at birth than their ancestors could. The procedure consists of choosing only open-faced sheep for mating, instead of woolly-faced ones.

The average production of today's hen—about 210 eggs per year—is twice what it was 100 years ago. And many believe hens will average 250 eggs a year within a decade. Improved feeding, management, and research-inspired crossing of inbred lines are responsible for the increase.

Developing rations that increased the efficiency of converting feed into meat, however, has been the most successful of poultry research efforts. About 5 pounds of feed were required for each pound of weight gain by broilers in the 1930's. Less than 3 pounds are needed to produce a pound of gain today. Specialized, fast-gaining, meat-producing strains; tailor-made, high-energy, complete rations; and expert management have accounted for this big increase.

But despite all this progress, important problems remain unsolved. For example, most farm animals still need about as much feed as they ever did to put on a pound of gain. Beef cattle have required about 9 or 10 pounds of feed per pound of gain since 1900. Feed efficiency of dairy cows also has changed little—in 1910 it was 1.2 pounds of feed per pound of milk; in 1962 it still is more than a pound of feed per pound of milk. Hogs need more than 5 pounds of feed to gain a pound, compared to 6½ pounds needed in the early 1900's.

ARS and cooperating scientists are working now to increase the feed efficiency of these animals.☆

Now Dairymen can use THI

■ The U.S. Weather Bureau's temperature-humidity index can be used to estimate summer declines in milk production by dairy cattle, USDA-State research has shown. THI is a numerical expression of the discomfort people are likely to feel due to the combined effects of temperature and relative humidity.

When the THI in an area reaches 75, about half the population will feel some discomfort. At a THI of 80 or above, nearly everyone feels uncomfortable.

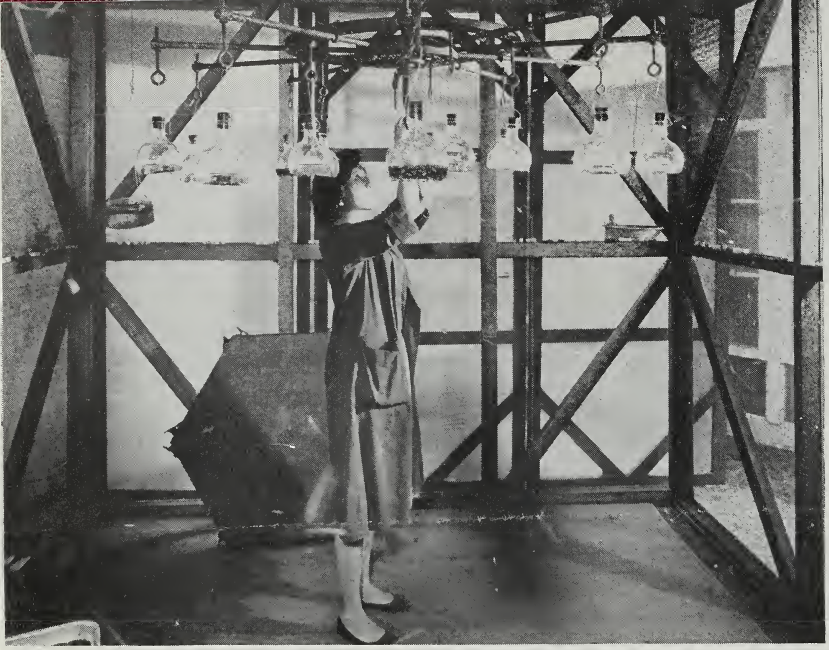
ARS agricultural engineer I. L. Berry and agricultural engineer M. D. Shanklin and dairy husbandman H. D. Johnson of the Missouri Agricultural Experiment Station learned that a THI as low as 71 causes a drop in milk production of high-producing cows (those giving 60 pounds of milk per day).

The researchers charted the effects of various combinations of temperature and humidity on milk production. For example, at a THI of 75, production drops about 10 percent; at 80 it drops about 20 percent; and at 90 it drops about 45 percent. An air temperature of 85° F. and a humidity of 33 percent is one combination that gives a THI of 75. At 100° F. and 58 percent humidity, the THI is 90.

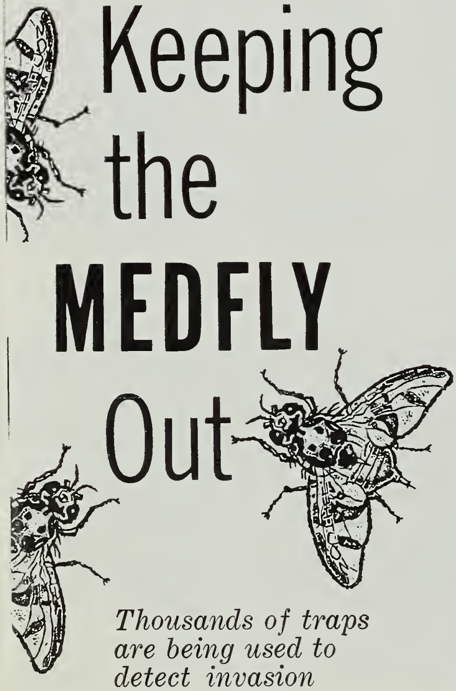
The effects of temperature and humidity on milk production of 56 Holstein cows were studied to develop data that could be used as a guide for determining cooling needs in dairy shelters.

If the THI averages more than 71 during the summer, a dairyman can expect less milk than usual from his cows—unless he makes dairy shelters cooler.

Average temperature-humidity indexes are available from local weather stations.☆



Seeking potent lures, worker (left) compares number of flies attracted to different chemicals in Hawaii. From launch, inspector (above) sets Medfly detection traps along river dividing Nicaragua and Costa Rica.



Keeping the MEDFLY Out

Thousands of traps are being used to detect invasion by this insect

■ Hanging inconspicuously in fruit trees of North and Central America and the West Indies are thousands of small plastic or glass traps. They form an agricultural DEW line, a "distant early warning" if the Mediterranean fruit fly should spread to the north from the Central and South American countries it infests.

The Medfly's closest reported approaches to the continental U.S. are in Bermuda, Costa Rica, Nicaragua, and Hawaii. First found in Venezuela in 1960, the fly also infests Argentina, Brazil, Peru, and Uruguay in South America.

In the U.S., ARS and cooperating States operate some 8,000 traps in detection surveys across 9 southern States—west to California—with a high concentration in Florida. Pest control workers of ARS and the Direccion General of Agricultural Defense of the Secretariat of Agriculture and Livestock of the Republic of Mexico cooperatively operate about 3,500 traps in Mexico, including a circle of some 1,700 in Chiapas, Mexico's southernmost State, just north of the Guatemalan border.

Medfly work in Central America is under auspices of the Regional International Organization of Plant and Animal Health (OIRSA). ARS helps to furnish traps and the Medfly lure in Central America, the West Indies, and Chile; in some areas—in Puerto Rico and the Bahamas, for example—it cooperates in servicing the traps.

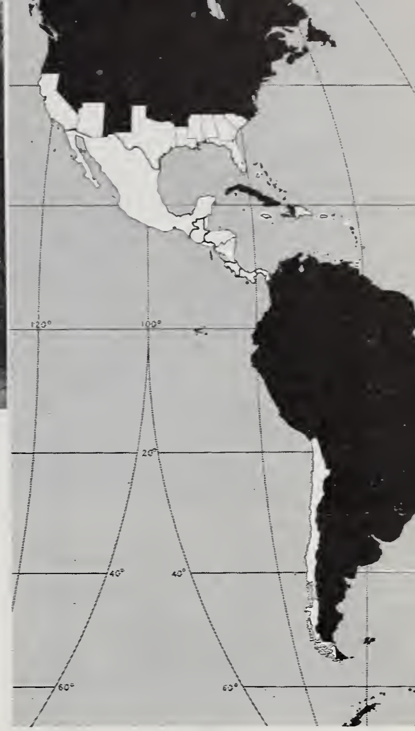
Detection surveys are only one protection against the fruit and vegetable pest which invaded Florida in the late 1920's and 1950's. Both invasions were stopped at a cost of almost $20 million.

Medfly invasion is always possible

Danger of Medfly invasion is always present, and has been multiplied by people and goods traveling more and faster, particularly by air. Other safeguards against the pest are quarantine inspection and training, control in infested areas, and research

Geiger counter detects flies marked with radioactivity to determine flight range.

OIRSA inspector sprays orange tree with insecticidal bait to control Medfly in Costa Rica.



Map shows countries known to be using detection traps. Other weapons: quarantine, education, chemical and biological control, research to improve lures and adapt induced-male sterility techniques.

for better ways to detect and destroy the fly and stop its movement.

Plant quarantine inspection at seaports, airports, and land ports of entry has been tightened in many countries since the fly was found in Costa Rica and Nicaragua. Last year ARS plant quarantine inspectors stopped the Medfly from entering the U.S. 195 times, and they also destroyed the pest in Florida on Mexico-bound planes from infested countries. Mexico has increased its guard at the Mexico City airport and has established regulatory measures against the entry of the Medfly from Central America at ports of entry on the Guatemala frontier.

OIRSA encourages plant quarantine services in all member countries—Mexico, Guatemala, El Salvador, Honduras, Nicaragua, Costa Rica, and Panama. Most Central American countries have adopted uniform quarantine regulations that help to prevent Medfly spread. ARS assists Medfly-infested countries in establishing fruit fly-killing treatments so that fruit can be exported safely. ARS has trained Mexicans and South and Central Americans at USDA's Plant Quarantine Training School in New York or in Mexico City or Costa Rica. Most of the quarantine inspectors in OIRSA-member countries have taken OIRSA's International Course of Plant and Animal Quarantine in Costa Rica. Scientists from several Central American countries have received training in biological control at Mexico's Biological Laboratory in Mexico City.

Americas may gain from work elsewhere

In other areas, research on the Medfly and other fruit flies may benefit the Americas. At ARS laboratories in Honolulu and Mexico City, an intensive search for highly effective lures is going on. Lures used in traps are being improved. If strong enough lures are found, eradicating fruit flies from Hawaii and other islands may be possible.

Scientists are adapting for use in Medfly eradication the induced-male sterility technique which recently rid the Southeast of the screw-worm, costly livestock pest. Release of Medfly males made sterile by irradiation from radioactive cobalt has given ARS scientists encouraging preliminary results in tests in Hawaii.

Methods developed there are being used by Egyptian scientists in a 5-year study supported by funds from sale of surplus U.S. agricultural commodities to Egypt. Similar work is underway in Costa Rica, where OIRSA collaborates with the Inter-American Institute of Agricultural Sciences.

Mexican scientists have been cooperating with Nicaragua and Costa Rica. A number of fruit fly parasites from Mexico have been released in the infested areas of these countries. Parasitization of Medflies in increasing numbers has been reported in these areas, indicating that several parasitic species may prove effective.☆

Breeding has increased rotenone content of this foreign plant, which grows well in the U.S.

A DOMESTIC SOURCE OF ROTENONE

■ A wild African plant that contains rotenone in its leaves is being improved by USDA scientists in Puerto Rico to provide a domestic source of this natural insecticide.

Goal of the research is to establish a line of the plant (*Tephrosia vogelii*) that contains an average of 6 percent rotenoids, an amount considered necessary for commercial production of rotenone. It makes up about half the total rotenoids.

ARS plant physiologist J. E. Irvine and agronomist R. H. Freyre now have a good basis for developing a commercial variety from some individual plants that assayed over 6 percent rotenoids. These plants are part of a third-generation population, developed through breeding and selection, that averaged 3.6 percent rotenoids. Rotenoid content was increased in each generation.

T. vogelii has grown well in field tests in California, Florida, Georgia, Louisiana, South Carolina, and Texas. Because rotenone is deposited in its leaves, rather than roots, the plant can readily be machine-harvested. Present sources of commercial rotenone are the roots of the tropical plants *Derris* and *Lonchocarpus.*

Efforts by Irvine and Freyre to develop a domestic source of rotenone began with 16 *Tephrosia* species collected from 13 tropical countries. Assay tests of leaves, stems, roots, and seeds showed rotenoids occurred in the leaves of five of these species. *T. vogelii,* which had the highest leaf rotenoid content, was selected for further study.

Seeds came from various countries

The scientists obtained seeds of different varieties of *T. vogelii* from various tropical countries and grew them in replicated plots at the Federal Experiment Station, Mayaguez, P.R. Analyses of differences in rotenoid content of the introductions showed that this characteristic is probably genetically controlled.

Following these tests, Irvine and Freyre began crossing and selection, which resulted in the lines now being used to develop a commercial variety. Breeding is done in Puerto Rico because *T. vogelii* doesn't set seed during the shorter growing season in the continental U.S. Commercial seed would be produced in Puerto Rico.

Rotenone, like other natural insecticides, leaves little toxic residue, and insects have not developed resistance to it as they have to synthetic insecticides. It is presently recommended for controlling lice and ticks of livestock and poultry and many pests of garden vegetables.☆

TWO USES FOR DIURON IN COTTON

■ Diuron, a herbicide widely used in Western irrigated cotton fields to control weeds after the last cultivation, is also effective in a preplanting treatment.

The preplant spray application prevents emergence of weeds such as barnyard grass, lambsquarters, pigweed, and morning glory.

Research indicates that diuron can be used for full-season control of annual weeds in irrigated cotton in the West by supplementing current practices with this new method of application. Encouraging results in the preplant use of diuron have been obtained since 1956 in Arizona Agricultural Experiment Station-USDA studies by State agronomist K. C. Hamilton and ARS plant physiologist H. F. Arle and agronomist G. N. McRae.

A few annual weeds usually develop in treated fields in the period between cotton emergence and the

first postemergence irrigation. These weeds can be eliminated by using a mechanical cultivator. When diuron is applied during cultivation, there will be little or no weed growth the remainder of the season.

Weeds are controlled best but the cotton stand may be reduced when preplant diuron is applied before furrowing. Applications made after furrowing provide adequate weed control but have less effect on cotton.

Rainfall occurring when the first cotton sprouts appear hastens the action of the herbicide and may cause a reduction in cotton stands in treated fields. Cotton plants in treated fields may be weakened by the herbicide and become more susceptible than plants in untreated fields to *Rhizoctonia*, a seedling disease. Seed placement and other planting practices influence the sensitivity of cotton to the herbicide.

Preplant irrigation methods influence the effect of diuron on cotton. With normal furrow irrigation the diuron has little effect on the crop. But with flood irrigations that cover the seedbed, severe loss of cotton plants may result if soils are more than 30 percent clay and less than 25 percent sand.☆

Coming:
BORER-RESISTANT GRAIN SORGHUMS

■ Kafir-type grain sorghums have more resistance to the European corn borer than milo types, USDA and Iowa scientists learned in a 3-year study of borer damage to these two main types of grain sorghums.

ARS entomologists F. F. Dicke and G. R. Pesho and Iowa agronomist R. E. Atkins also discovered an easy and accurate way to measure borer resistance. They do this by counting the number of larval cavities in the top internode (between top node and seedhead) in October.

Of more than 30 varieties tested, three kafir-type sorghums—Pink Kafir, Fremont, and Texas Blackhull Kafir—were among the most resistant to borers. Such milo-type sorghums as Sooner, Reselect Double Dwarf Yellow Sooner, and Double Dwarf Yellow Milo showed the most susceptibility to borer damage. Crosses of kafir and milo lines were intermediate in susceptibility to the insect.

The three most susceptible milo-type sorghums averaged about 12 times as many larval cavities for the 3 years as the three most resistant kafir-type sorghums.

Armed with this knowledge, agronomists now can breed borer-resistant sorghums. Resistant varieties are needed, now that sorghum production has expanded in areas which usually have large borer populations.

The scientists screened sorghums in field plots at Ankeny, Iowa. They attached corn borer egg masses, which were about ready to hatch, near the top leaves of sorghum plants in the early or active pollen-shedding stage. Extent of infestation was determined in October.

Three-fourths or more of the borer damage occurred in stems between the top node and seedhead. This damage is by second-generation borers, which hatch when sorghum plants are in bloom or are shedding pollen. First-generation borers cause only limited injury to sorghum leaves.

Large numbers of larval cavities in stems cause grain heads to bend over or break and fall to the ground. Such stem breakage was extensive in most milos in the experiments.

The Iowa Agriculture and Home Economics Experiment Station cooperated in the research.☆

Early corn borer larvae injure leaves of susceptible sorghums (left) and cause them to break off. Advanced-stage larvae weaken the stems. Heads break over (right) and fall to the ground. Kafir-type grain sorghums have 12 times the borer resistance of milo types.

Three new chemicals performed well in several important crops last year, but scientists want to conduct more tests before recommending these

Pre-Emergence Weed-Killers

■ Dipropalin, trifloralin, and diphenamid, new chemicals included in USDA's 1961 herbicide evaluation program, showed great potential as preemergence killers of weeds in several crops. Before the chemicals can be used commercially, however, further tests must be made to determine any undesirable characteristics.

Dipropalin (N,N-di-(*n*-propyl)-2,6-dinitro-4-methylanaline) applied at rates of 4 to 8 pounds per acre was tolerated by alfalfa, field corn, cotton, flax, peanuts, soybeans, sugarbeets, broccoli, cabbage, field cress, kale, and parsley. Satisfactory control of pigweed, ryegrass, carpetweed, crabgrass, and lambsquarters was obtained by using 4 pounds per acre.

Trifloralin (N,N-di-(*n*-propyl)-2,6-dinitro-4-trifluoromethylanaline) appeared promising in tests on several field and horticultural crops. Field corn, cotton, flax, peanuts, and safflower tolerated 6 pounds per acre, and there was no visible injury. Broadleaved and grassy weeds were eradicated or controlled by treatments of 4 pounds per acre.

Eight pounds of trifloralin per acre were tolerated by broccoli, cabbage, cauliflower, collards, kale, lima beans, parsley, peas, snapbeans, sweetcorn, and turnips. Pigweed, ryegrass, carpetweed, crabgrass, and lambsquarters were eradicated in light soils by 1 pound. This compound also gave good control of crabgrass in turf, but there was some turf damage where applications exceeded 4 pounds per acre.

In heavy soils, 6 to 8 pounds per acre of diphenamid (N,N-dimethyl-a, a-diphenylacetamide) produced no visible damage to alfalfa, cabbage, field and sweet corn, cotton, flax, lima beans, peanuts, peas, safflower, snapbeans, soybeans, squash, sudangrass, sugarbeets, tomatoes, and turnips. Pigweed and ryegrass were eradicated by 1 and 4 pounds, respectively.

In light, sandy soils, broccoli, cabbage, cauliflower, Hanover salad, kale, mustard greens, parsley, and turnips tolerated 2 to 3 pounds of diphenamid per acre. Complete control of pigweed, ryegrass, carpetweed, and crabgrass was obtained by using ½ to 1 pound per acre.

In studies by Federal, State, and industry scientists, diphenamid showed promise as a preemergence or posttransplanting treatment in tomatoes and peppers when used at the rate of 3 to 5 pounds per acre, and as a posttransplanting treatment of 5 pounds per acre in annual flowers. Postemergence treatments of 5 pounds per acre gave good control of weeds in cucumbers, cantaloupes, watermelons, and squash.

The researchers obtained almost full-season weed control in strawberries by treating with 2½ to 10 pounds of diphenamid per acre. The chemical was applied just after the plants were set out. Some damage to runners resulted from the high application rate.

The herbicide evaluation program conducted by ARS scientists at the Agricultural Research Center, Beltsville, Md., is designed to minimize the need for other Federal and State scientists to test every potential weed-killer. Scientists in other areas need choose only those chemicals that are promising at Beltsville. These chemicals can then be tried and modified in attempts to improve weed control in particular areas. ☆

HERBICIDE'S EFFECTIVENESS CONFIRMED

■ Field trials on 20,000 acres have confirmed earlier research findings that DPA (3,4-dichloropropionanilide) effectively controls barnyard grass, the most troublesome weed in rice.

DPA gave good control of barnyard grass in at least 95 percent of the rice fields treated with it in 1961 in the Southeast. In the previous 2 years, it had shown promise in cooperative research conducted by ARS agronomist R. J. Smith, Jr., at the Arkansas Agricultural Experiment Station, and ARS agronomist K. L. Viste at the California Agricultural Experiment Station.

Use of CIPC (isopropyl N-(3-chlorophenyl) carbamate), the herbicide presently recommended for control of the weed in Arkansas, demands careful management to avoid injuring the rice plants. Management precautions are much less critical with DPA than with CIPC, because of DPA's low toxicity to rice (AGR. RES., Jan. 1961, p. 5).

Application rate was 4 pounds per acre

Effective control of the weed was obtained by spraying DPA at a rate of 4 pounds per acre in a water solution when barnyard grass was in the second- or third-leaf stage of growth.

DPA can be applied with tractor-drawn or airplane equipment, Smith learned. In either case, the amount of solution applied should be at least 10 gallons per acre. When airplane equipment is used, the swath width should not be more than 30 to 40 feet to ensure uniform application of the spray.

Spray drift from ground and airplane applications appears to be reduced as the volume per acre of spray solution increases. DPA drift may injure other plants, including cotton and soybeans, and certain horticultural and ornamental plants. Precautions to avoid spray drift should be followed carefully to avoid damage to nearby susceptible plants.

Irrigation no earlier than 12 hours after DPA treatment does not affect the activity of the herbicide on barnyard grass or rice. However, rain occurring 6 to 12 hours after treatment may wash the DPA from grass leaves and reduce its activity.☆

CHEMICAL INHIBITS LEAF WAX

■ Control of weeds that develop a thick coating of herbicide-repelling leaf wax may someday be improved by using a chemical that inhibits wax development.

Applications of EPTC (ethyl N,N-di-*n*-propylthiolcarbamate) reduced formation of wax on cabbage leaves by more than 90 percent, according to ARS plant physiologist W. A. Gentner. This increased susceptibility of the plant to herbicides—the greater the wax reduction, the greater the penetration of herbicides.

Cabbage was used because it normally develops a thick coating of leaf wax. Weeds also having a heavy wax coating include mesquite, oxalis, and lucerne.

In tests at USDA's Agricultural Research Center, Beltsville, Md., EPTC and some other thiolcarbamates restricted development of wax only on those leaves that were in bud stage when the chemical was applied. There was no effect on leaf wax already formed at the time of treatment.

When EPTC was applied as a spray, it restricted wax development on leaves that were in bud at the time of spraying.

In another method of application, plants were exposed to vapors that arose from granules placed under the plants in a dish. The granules were removed and replaced several times during the test. All leaves in bud stage when the granules were present developed without leaf wax; all those in bud when the granules were not present developed normal wax.

Although this preliminary research offers hope for improved weed control by preconditioning plants with wax inhibitors, much more research is needed to determine if this work has practical application.☆

Method seems good for treating small, high-value areas

SPRAYING FORESTS BY HELICOPTER

Spray boom, similar to ones on single-engine, fixed-wing planes, is 21 feet long.

■ Helicopters may be valuable for applying insecticides to small, high-value forest areas such as Christmas tree plantations.

This is the conclusion of USDA researchers from evidence of recent tests and past limited use of helicopters in experimental and operational forest insect control.

Sprays from a helicopter were more evenly distributed across a 100-foot swath than those applied by a light, fixed-wing aircraft, in tests by ARS agricultural engineer D. A. Isler and entomologist Bohdan Maksymiuk of the Forest Service.

Moreover, because helicopters are highly maneuverable and can travel at slow speeds, operators are better able to uniformly cover spray areas. The small carrying capacity and present high operating cost of helicopters limits their use to small areas of high value. For large forests, planes capable of carrying 400 to 3,000 gallons of spray are used.

Tests with the helicopter were made as part of continuing research to determine the most efficient and economical methods of aerial application of insecticides to forests.

The tests were made at the Agricultural Research Center, Beltsville, Md. Isler and Maksymiuk measured the amount of spray striking the ground at 5-foot intervals along a 100-foot swath. In five flights, spray deposited from the center of the path of the helicopter to 45 feet on either side of it averaged between 0.4 and 0.8 gallon per acre.

Distribution was evener than from plane

Most significantly, the pattern of distribution was more even than that given by a fixed-wing plane, where sprays tend to fall in heavier amounts at two points on either side of the plane, with a low deposit rate in the center.

Drop size of the spray when it reached the ground was comparable to that delivered by fixed-wing planes.

Size of drop and distribution of sprays across swaths are the two main factors in aerial application of insecticides studied by Isler, chief entomologist J. S. Yuill, and associates at the Forest Insects Laboratory, Beltsville. Three fixed-wing planes are regularly used in their experiments; the helicopter was loaned by a private company.

Drop size is important for effective coverage of insects and foliage. A fine spray covers more surface area than a coarse spray.

For aerial spraying of insects that defoliate trees, however, a spray ranging in the middle in drop size gives the best control. A high proportion of finely atomized sprays may be lost because of drift.

Size of spray drops, therefore, also affects *distribution* of the spray across the swath. In any spray, fine or coarse, there is a range in drop size. The greatest number of drops in a spray must be of a size that will reach the area to be treated and give the best surface coverage.

What makes drop size? Factors that would operate in spraying from the ground, such as size of nozzle opening and spraying pressure, have relatively little effect in the air.

Isler and Yuill find that two factors seem to be most important in regulating drop size in aerial sprays: speed of the aircraft, and the direction spray nozzles face in relation to flight direction. Velocity of the air and velocity of the spray as it meets the air cause the breakup of the liquid into drops.

Other factors besides drop size that affect spray distribution are: arrangement and location of the nozzles across the spray boom; aircraft wing span; the spiral movement of air at the wing tips; and height of the plane above the ground. Wind, humidity, and temperature must also be taken into account in designing experimental and control procedures.

Better spray control may reduce costs

The researchers hope to reduce spraying costs by developing better control of drop size and distribution. If sprays can be better distributed, less insecticide per acre may be used. Present rate of application for forest defoliating insects is about 1 gallon per acre of a spray of 1 pound of DDT in oil solution.

The entomologists are working to develop more effective sprays for various insects that attack trees.☆

New Pesticides Regulation Division

A Pesticides Regulation Division has been established in ARS to carry out increasing USDA responsibilities for safe and effective use of pesticide chemicals.

ARS administrator B. T. Shaw says this division was created to give greater emphasis to work previously conducted as part of the Service's plant pest control operations.

PRD will administer the Insecticide, Fungicide, and Rodenticide Act and that part of Public Law 518 assigned to USDA. Director of the division is J. C. Ward, who has been in charge of these regulatory functions since 1957.

Many new insecticides, herbicides, germicides, and rodenticides are being developed and sold interstate. PRD must register and approve the labeling of these chemicals.

Ward and his group work closely with other units of USDA and with the U.S. Food and Drug Administration, to make sure that registered pesticides are useful and safe to use, and to keep harmful residues of these chemicals out of foods and feeds.

The division also cooperates with the U.S. Public Health Service, U.S. Fish and Wildlife Service, American Medical Association, World Health Organization, pesticide manufacturers, State and local officials, and other groups concerned with safe use of pesticide chemicals.

Improved water-hyacinth control

Single applications of amitrole-T control water-hyacinth more effectively than single applications of 2,4-D, the herbicide usually used to fight this aquatic weed.

Amitrole-T is a combination of amitrole (3-amino-1,2,4-triazole) and ammonium thiocyanate (NH_4SCN). In a 3-year series of field tests at Florida's Plantation Field Laboratory, Fort Lauderdale, the most efficient formulation contained equal parts of the chemicals.

Investigations by ARS plant physiologist D. E. Seaman show that sprays of 0.5 to 2 pounds of amitrole-T per acre control the weed better than 2 to 6 pounds per acre of 2,4-D.

Maximum effects of amitrole-T develop about 4 weeks later than those of

2,4-D but there is less regrowth of the weed when amitrole-T is used. USDA laboratory studies indicate that amitrole-T inhibits regrowth by being translocated through stolons from parent to offshoot plants.

The regrowth of plants treated with 2,4-D is probably a result of poor translocation of the chemical.

Water-hyacinth is troublesome in waterways, irrigation ditches, and drainage ditches—especially in Florida, Louisiana, and Mississippi.

Knowledge of cattails gained

Now scientists know why cattails can quickly infest moist pastures and interfere with normal waterflow in drainage canals in the West.

A detailed investigation of the life history of the cattail (*Typha latifolia*) showed that a maze of rhizomes and shoots from one seed can spread over an area 10 feet in diameter in just 6 months.

This research illustrates scientists' increasing emphasis on the study of weed physiology and especially reproductive characteristics. The information is used to find how to grow weeds for herbicide research and to find a point in a weed's life cycle at which the plant may be vulnerable to control measures.

As many as 222,000 brown cattail seeds may be produced on a single mature spike 7 inches long. These seeds germinate in mud or water. When a seedling has grown to a height of 8 to 12 inches, a rhizome begins to grow laterally, and a new shoot develops from a node, 1 to 2 feet from the first shoot. More rhizomes and shoots grow until a massive network is formed. In 6 months one cattail specimen developed 104 visible crown buds and 63 shoots that grew as tall as 48 inches.

The cattail study was made by ARS agronomist R. R. Yeo in cooperation with the Bureau of Reclamation and the Montana Agricultural Experiment Station, Huntley.

Confectionery fat being evaluated

An experimental confectionery fat, strikingly similar to cocoa butter, has been developed from cottonseed oil and olive oil by USDA chemists.

This new product is being evaluated for use in candies and baked goods by the National Confectioner's Association and several candy manufacturers. It remains hard and brittle at room temperatures, but begins melting quickly when placed in the mouth.

Cocoa butter, which melts quickly and completely in the mouth, is highly prized as a confectionery fat. Tests of the new fat as a replacement for cocoa butter in candies showed that tiny amounts of the fat fail to melt

UNITED STATES GOVERNMENT PRINTING OFFICE
DIVISION OF PUBLIC DOCUMENTS, WASHINGTON 25, D.C.

OFFICIAL BUSINESS

PENALTY FOR PRIVATE USE TO AVOID
PAYMENT OF POSTAGE, $300
(GPO)

in the mouth. Candy made with this product does not shrink away from the molds as readily as candies made with cocoa butter.

ARS chemists believe, however, that these shortcomings of the new confectionery fat can be corrected through further research.

To make this product, R. O. Feuge and N. V. Lovegren of the Southern utilization division, New Orleans, La., chemically modified a 3-to-1 mixture of hydrogenated cottonseed oil and olive oil and crystallized out the cocoa-butter-like fat. Very little oil was lost in the process.

Preliminary cost studies indicate that commercial production of the new confectionery fat should be economically feasible. Based on probable processing costs and on recent prices of cottonseed oil (15 to 17 cents a pound) and olive oil (30 to 33 cents), the new fat can be produced for about 40 cents a pound.

The price of cocoa butter has ranged from about 60 cents to more than $1.00 a pound during recent years.

Multipurpose finishing treatment

A method has been developed to impart wash-wear properties and permanently attach dyes, starch, and other finishing materials to cotton in a single chemical treatment.

Derivatives of divinyl sulfone are used in the treatment devised by USDA chemists C. M. Welch and J. D. Guthrie. These chemicals have the unusual ability to react with cotton's cellulose molecules to produce a good wash-wear finish, while permanently attaching other finishing materials to the cellulose.

Experiments at the ARS Southern utilization division, New Orleans, La., strongly indicate that the process may be used to impart to cotton resistance to fire, heat, rot, and mildew. It may also provide some repellency to water and oil.

The multipurpose treatment also allows textile finishers to attach to cotton many beautiful and inexpensive dyes that by themselves do not have an affinity for cotton. The dyes are simply added to the treating solution to color the fabric while other properties are imparted.

For example, by adding starch and a dye to a solution of the derivatives, a permanently starched and colored wash-wear finish can be obtained. Treated fabrics resist damage from chlorine bleaching.

Conventional textile finishing equipment can be used to apply the finish. The fabric is dipped into the chemical solution, run through squeeze rolls to remove excess solution, and dried and cured at temperatures ranging from 120° to 180° C.

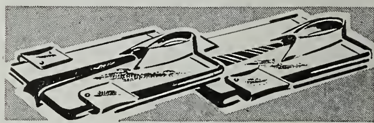
Longer service from men's shirts

A wash-wear treated interliner bonded to outer layers of untreated cotton in collars and cuffs of men's wash-wear shirts may result in longer service life.

The bonded interliner shares its wash-wear properties with the untreated cotton. And the untreated fabric offers the high resistance to fraying associated with cotton.

This work was conducted by ARS chemists T. W. Fenner, R. M. Reinhardt, and J. D. Reid of USDA's Southern utilization division, New Orleans, La.

They made three sets of samples duplicating as nearly as possible standard collars and cuffs. One set was made by sewing together three



layers of untreated broadcloth. The second was made of three layers of wash-wear treated broadcloth. The third was made of a single layer of wash-wear treated broadcloth sandwiched between and bonded to untreated broadcloth with a special adhesive.

Samples of untreated cotton and those with the treated interliner were approximately equal in fraying resistance. They were substantially more resistant than samples made of three layers of treated fabric.

Samples made with the treated interliner were somewhat stiffer than the usual soft collars and cuffs, but were less stiff than acceptable starched cotton collars and cuffs.

Wash-wear ratings of the new product were excellent—5 on the generally accepted rating scale of 1 to 5.

U.S. GOVERNMENT PRINTING OFFICE: 1962